Wetting transitions on textured surfaces(Poster session 2, New Frontiers in Colloidal Physics : A Bridge between Micro- and Macroscopic Concepts in Soft Matter)

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微細加工技術の発展に伴い、ミクロンあるいはナノオーダーの規則的な凹凸をもつ表面が作成できるようになった。その様な表面上での濡れ方はいろいろ考えられる (図 1)。表面エネルギーが最小となる液滴の濡れ方はテクスチャーのパラメータに応じて理論的に計算できるが、実際にこのような表面上に液滴を置いてみるとエネルギー状態が最小となる状態とは異なる準安定状態が実現することがよくある。本研究では、中心から表面に沿うような濡れが発達しながら準安定状態から最小エネルギー状態に向かう際のエネルギー変化について、接触角履歴も考慮して説明する。

Recently, many groups have been made surfaces with texture on micron- or nano- scales, aiming at various kinds of application. When a liquid drop is deposited on such a textured surface, wetting is categorized by three contact states: (1) "Wenzel state" where liquid follows the surface texture, (2) "Cassie state" where air is trapped between the solid surface and the bottom of the liquid drop, and (3) "Sunny-side up state" where penetrating front is spreading like a sunny-side up (Fig.1).

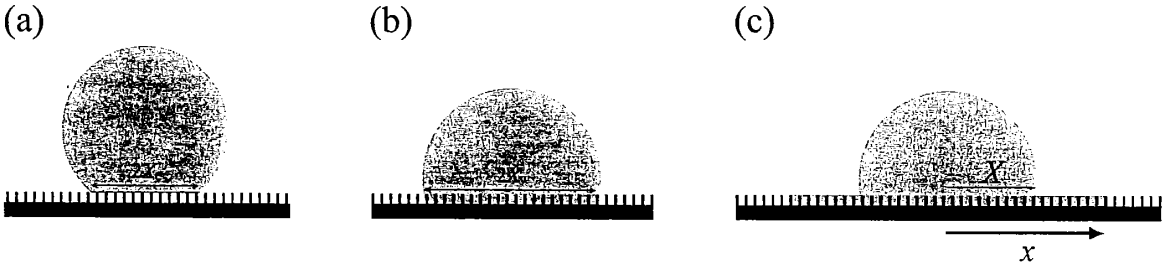

Figure 1: Wetting states on a textured surface. (a) Cassie state, (b) Wenzel state, and (c) sunny-side up state.

In our previous study, we calculated a surface energy of a liquid drop during a transition from the Cassie state to the Wenzel state on a textured surface. We assumed that the bottom surface of the drop went down uniformly towards the bottom of the solid surface until the Wenzel

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contact was established. As a result, we showed that the energy barrier could be much grater than thermal fluctuation [1].

In this study, we developed a model of transitions in a different mode, both on a hydrophobic [2] and hydrophilic surfaces, including the effect of contact angle hysteresis which was neglected in the previous study.

References

[1] C.Ishino, K.Okumura and D.Quere, Europhys Lett.**68**, 419 (2004).

[2] C.Ishino and K.Okumura, Europhys Lett. **76**, 464 (2006).